

REMARKS/ARGUMENTS

The present Amendment is responsive to the non-final Office Action mailed December 17, 2008 in the above-identified application.

Claims 12 and 14-21 are the claims currently pending in the present application.

Claims 12 and 14 are amended to clarify features recited thereby. These amendments are fully supported by Applicant's disclosure, see, for example paragraph bridging pages 19 and 20 of the Specification and Figures 3 and 4.

Applicant thanks the Examiner for acknowledging review and consideration of the references cited in the Information Disclosure Statement filed on August 1, 2008.

Rejection of Claims 12, 14-16 and 18-21 under 35 U.S.C. §103

Claims 12, 14-16 and 18-21 are rejected under 35 U.S.C. §103, as being obvious over Cho et al., "Generation of 90-nJ pulses with a 4-MHz repetition-rate Kerr-lens mode-locked Ti:Al₂O₃ laser operating with net positive and negative intracavity dispersion," Opt. Lett. 26, 560-562 (2001) (hereinafter Cho), in view of Szipócs, U.S. Patent No. 5,734,503.

Reconsideration of this rejection is respectfully requested.

Claim 12 requires a short-pulse laser arrangement comprising a resonator comprising resonator components, a first set of the resonator components having a positive group delay dispersion, and a plurality of mirrors including dispersive mirrors with a negative group delay dispersion, wherein in operation of the resonator the positive net averaged group delay dispersion of the resonator is in range between 0 and 100 fs².

As discussed, for example, at Specification, page 19 and Figures 3 and 4 of Applicant's disclosure, according to an aspect of Applicant's invention as claimed in claim 12, a short-pulse laser arrangement includes a resonator operating with a specific group delay dispersion (GDD) management to allow for very short pulses. This is achieved by using specific dispersive mirrors with a negative GDD to adjust the averaged GDD of the resonator during operation, and in operation the resonator has a positive net averaged GDD in the range 0 to 100 fs². A further discussion of the effects of a positive averaged GDD in this range is provided in Specification, pages 20 and 21 of Applicant's disclosure.

It will be recognized that claim 12 makes clear that the resonator has a positive net averaged GDD. Claim 12 recites that the resonator in operation has "a positive averaged group delay dispersion over an operating wavelength range." Moreover, claim 12 makes clear that this

positive averaged GDD is in the range of 0 to 100 fs². As discussed in the Amendment filed on August 1, 2008, in a surprising finding for the inventors, such a range has the effect that at extremely high intracavity energies, a small but constant dispersion in the resonator can still allow pulses having a large frequency bandwidth and to this end the dispersion need not be too high.

Cho discloses a short-pulse arrangement including prisms to introduce a negative dispersion within the resonator (Cho, page 561, right-hand column). Cho discloses fused silica prisms.

The Office Action takes the position that it would have been obvious to replace the fused silica prisms as disclosed by Cho with the dispersive mirrors taught by Szipócs.

First, as illustrated in Figure 1 of the present application, a prism compressor 31 with prisms 32 and 33 may be provided, and these prisms 32 and 33, not dispersive mirrors, are provided for in the embodiment of Figure 1.

Dispersive mirrors had been known at the time of the publication of Cho, as was the technique of Szipócs. Cho knew about the use of dispersive mirrors having a negative GDD. Nevertheless, Cho did not disclose, let alone address the problem of having a laser with a positive net averaged dispersion that was too high or the undesirable effects of such high positive net averaged dispersion resonators with respect to the generation of short laser pulses and large bandwidth. Cho is silent as to such problems. In fact, Cho at page 562, left column, final complete paragraph, last sentence, teaches that “positive dispersion KLM might be able to generate transform-limited pulses if specifically designed chirped mirrors, gratings, or prism compressors are used to compensate for the chirp or if a method for better controlling the phase of the mode-locked pulse can be developed.” This demonstrates that Cho had no knowledge of the solutions disclosed in Applicant’s disclosure and recited in claim 12.

Because of the high ordered dispersion inherent in the use of a prism pair, the useful wavelength range in the net positive GDD regime is limited (Figure 4 of Applicant’s disclosure). For example, if a desired amount of GDD is adjusted for the center wavelength of the spectrum, for example around 800nm, smaller or even negative values of GDD are reached at wavelengths shorter than 800nm. Similarly, larger or more positive values of GDD are obtained at wavelengths higher than 800nm (the maximum and flattest region of GDD being around 850nm for fused silica prisms).

In a similar vein, the use of a prism pair does not support the approach of operating a resonator in the 0-100 fs² range. This is because as soon as the dispersion is reduced to that range, the useful bandwidth is limited by the variation of dispersion introduced by the prism pair (high order dispersion is introduced). This is in contradistinction to the fact that small values of GDD enable a broader spectrum generated in the resonator. If useful bandwidth is limited, no broader spectrum (which would correspond to the small values of GDD) can build up in a resonator using a prism pair for dispersion compensation. On the other hand, use of dispersive mirrors does not introduce such systematic variations in the GDD as a prism pair does. Therefore, the value of GDD can be kept in the desired range for a wider spectral range, which is necessary to support the wider spectrum generated in the resonator (as shown in Figure 4 of the present application). Accordingly, shorter pulses (after compression) are achieved compared to other approaches.

Figure 4 of the present application illustrates that the GDD is kept within a limited positive range. Prior art laser arrangements had to contend with a GDD with large fluctuations within the bandwidth range. Cho, in particular, refers to a much higher positive GDD (Cho, page 561, right-hand column, mentions a GDD of +390 fs²). This is approximately a fourfold increase over the upper limit value recited in claim 1 of the present invention. Cho, in fact, does not disclose or suggest a GDD between 0 and 100 fs². As discussed, Cho discloses a much higher (or much lower) GDD values.

Szipócs discloses dispersive mirrors, but does not disclose or suggest dispersive mirrors with a negative dispersion for compensating in part the positive dispersion of specific resonator components in the laser arrangement, as required by claim 1. Accordingly, even taken together in combination, Szipócs and Cho do not disclose or suggest the above-cited recitations of claim 12.

Moreover, it is respectfully submitted that Applicant's invention as claimed in claim 1 would not have been obvious to a person ordinary skill in the art, and that the Office Action appears to be engaging in impermissible hindsight reconstruction based on Applicant's own disclosure by combining Cho and Szipócs to arrive at the recitations of claim 1, because, as discussed, Cho discusses much higher net average dispersion values. Accordingly, the cited art does not disclose or suggest the recitations of claim 12.

Claims 14-16 and 18-21 depend from claim 12 and are therefore patentably distinguishable over the cited art for at least the same reasons.

In addition, claim 15 requires a multiple reflection telescope comprising at least one of the dispersive mirrors with a negative dispersion.

Szipócs does not disclose a multiple reflection telescope at all. Accordingly, Szipócs is incapable of disclosing or suggesting a multiple reflection telescope that includes the dispersive mirrors with a negative dispersion, as required by claim 15.

Further, claim 16 requires that all the mirrors of the resonator are dispersive mirrors with a negative dispersion. Szipócs and the cited art do not disclose or suggest such features.

Rejection of Claim 17 under 35 U.S.C. § 103

Claim 17 is rejected under 35 U.S.C. §103 as being obvious from Cho and Szipócs in view of Cunningham et al., U.S. Patent No. 5,701,327. Reconsideration of this rejection is respectfully requested.

Cunningham does not cure the above-discussed deficiencies of Cho and Szipócs as they relate to the above-cited features of claim 12. Further, the Office Action does not allege that Cunningham discloses or suggest such features. Accordingly, since claim 17 depends from claim 12, it is patentably distinguishable over the cited art for at least the same reasons.


Moreover, claim 17 requires that the resonator includes “a pair of glass wedges with positive dispersion.”

Cunningham at column 6, lines 42-44, discloses fused silica prisms 38 and 40. However, these prisms have nothing to do with glass wedges. An example of a prism compressor 30 is illustrated in Figure 1 of Applicant’s disclosure. Accordingly, for at least this additional reason, claim 17 is patentably distinguishable over the cited art.

In view of the foregoing discussion, withdrawal of the rejections and allowance of the claims of the application are respectfully requested.

Respectfully submitted,

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